NEW CONSTRAINTS ON MESSINIAN SEALEVEL DRAWDOWN FROM 3D SEISMIC DATA OF THE EBRO MARGIN, IBERIAN PENINSULA, AND IMPLICATIONS FOR EVOLUTION OF THE EBRO BASIN

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Abstract
In this study 3D seismic and well data from the Ebro Margin, NW Mediterranean Sea are used in combination with backstripping and coupled isostasy and river transport and drainage evolution modeling techniques. The objective is to present new lights on the origin and sedimentary processes that took place on the Messinian Erosion Surfaces (MES) of the Valencia Trough (Mediterranean Sea), to provide a minimum estimate of the sea level fall in the Ebro Margin and to offer new constraints on the evolution of the adjacent subaerial Ebro Basin.
Keywords: Continental Margin, Erosion, Evaporites, Messinian, Models

The recognition of subaerial erosional surfaces at the rims of the Mediterranean basin has been one of the first and strongest evidences put forth to support the hypothesis of an exceptional Messinian sea level low stand that exceeded substantially any possible eustatic change (e.g., [1]). This study builds on a large 2700 km^2 3D seismic survey, which provides unprecedented detail and areal coverage of the Messinian Erosion Surface (MES) on the Ebro margin. The aim of this paper is to present new lights on the origin and sedimentary processes that took place on the MESs of the Western Mediterranean Sea, provide a minimum estimate of the sea level fall in the Ebro Margin and offer new constraints on the evolution of the adjacent subaerial Ebro Basin, particularly with regard to the time when full open drainage conditions towards the Mediterranean of this formerly endorheic basin were reached. Four major seismic units are identified on the Cenozoic Ebro Margin, based on the seismic data, including two major prograding megasequences (Serravallian-Tortonian Castellón Group and Pliocene-Pleistocene Ebro Group) that are separated by a major unconfirmity: the MES (see also [2] and [3]). . Offshore, the MES evolves into a paraconformity and is onlapped by shallow water detrital bodies. The 3D seismic data provide an unprecedented view of the MES displaying characteristic features of subaerial incision including a drainage network with tributaries of at least five different orders, terraces and meandering rivers. The Messinian landscape of the Ebro Margin presents a characteristic stepped-like profile that allows to subdivide the margin in three different regions roughly parallel to the Present Day coastline. Such a stepped profile is also evident in numerous areas of the Mediterranean Sea [4, 5]. No major tectonic control exists on the boundary between the different regions. The boundary between the two most distal regions can be identified to mark the location of a relatively stable water table, and this is used in backstripping analysis to identify the sea level drop associated with the Messinian Salinity Crisis on the Ebro Margin: in the order of ~1300 m, in agreement with the maximum amount of fluvial incision on the margin. The MES on the Ebro Margin is dominated by a major fluvial system. The observed width of the channel and modelling results suggests that this major valley corresponds to the Messinian Ebro River that should have already attained a drainage area comparable to the present one. Constraints provided by the data set, onshore geology and coupled isostasy and river transport and drainage evolution modeling techniques indicate that drainage of the Ebro River into the Mediterranean Sea occurred prior to the Messinian, most probably during the Serravallian/Tortonian, which is the age of the first significant >1-km thick siliciclastic deltaic megasequence deposited in the Ebro Margin.

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